

## CURRENT TASKS

### Johnson Space Center

#### Task

Replacement/Refurbishment of JSC/NASA POD Specimens

#### Center Point of Contact

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#### Objective

To reestablish the capability at JSC to produce fatigue cracked POD certification specimens

#### Background

The NASA Special NDE certification process requires demonstration of NDE capability by test per NASA-STD-5009. This test is performed with fatigue cracked specimens containing very small cracks. The certification test results are usually based on binomial statistics and must meet a 90/95 POD. The assumption is that fatigue cracks are tightly closed, difficult to detect, and inspectors and processes passing such a test are well qualified for inspecting NASA fracture critical hardware. The JSC NDE laboratory has what may be the largest inventory that exists of such fatigue cracked NDE demonstration specimens. These specimens were produced by the hundreds in the late 1980s and early 1990s. None have been produced since that time and the condition and usability of the specimens are questionable.

#### Approach

The first task in this proposal is to inventory and document the currently existing POD specimen sets at JSC and assess their condition. The second task is to reassess and revalidate the specimen fatigue cracking procedures that were developed at JSC some years ago and rebuild that capability. The third task will be to begin producing POD certification with Special NDE flaw sizes; the initial effort is to produce four small sets of equal area cracks at aspect ratios of 0.5 and 0.1 in order to directly compare their detectability as a function of aspect ratio. Specimen sets in both aluminum and titanium will be produced. This initial effort will not only allow JSC to reestablish its POD specimen manufacturing capability, but it will also begin to answer the question raised regarding cracks of equal area at different aspect ratios being equally detectable. Task four will be to begin building new sets of flat panel specimens in aluminum, titanium, and Inconel. This will require fairly large sets of well controlled fatigue cracked specimens to be prepared. The 29 of 29 Point Estimate method requires a minimum of 29 cracks in a test set. In addition a number of cracks will have to be destructively tested to verify the reproducibility of the cracking process, plus a number of spares are desirable and a number of specimens will wind up being scrapped for one reason or another. An estimate of 50 cracks per set will have to be produced to get a full set of 29 cracks. The JSC Fatigue and Fracture facility is in a unique position to produce these samples at a high rate having the experience of having done this in the past, having developed unique starter notch designs for controlling the flaw shapes, and having a large inventory of modern fatigue cracking machines and crack monitoring equipment. Task five in the out years will examine procedures for producing more complicated fatigue cracked geometries and specimen types such as cracked holes, edge cracks, cracked round bars, and cracked threaded specimens. JSC will maintain custodial care, maintenance, tracking, and distribution of the sets as necessary.

#### Customers/Benefits/Products

The POD certification specimen sets produced under this proposal will be a NASA wide resource available to all centers and their contractors. The specimens will also be made available to other government agencies, our international partners and their contractors. The success of the proposal will be measured by the quality and the number of the POD certification specimens produced and by the availability and use of the specimens by the customers; the NASA centers and their prime contractors. Another measure will be the realization of unique specimen designs and geometries that better simulate real crack detection difficulties.

#### Status/Recent Accomplishments

- Assessed several sets of existing JSC POD specimens
  - 0.025 Titanium penetrant set determined to be in usable condition
  - 0.050 Titanium penetrant sets (2) determined to be in usable condition
  - Aluminum eddy current bolt hole set determined to be in usable condition
- Previous fatigue cracking procedures being reviewed
- Fatigue bending apparatus assembled
- Titanium specimens acquired with scoop/rib starter notches
- Penetrant bench acquired
- UV camera acquired